Wire Insulation Incorporating Self-Healing Polymers (WIISP), Phase I

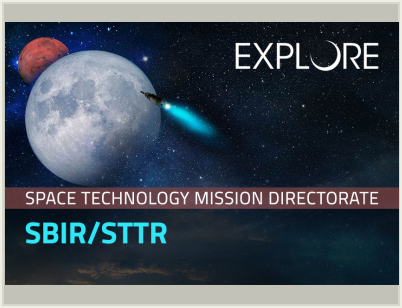
Completed Technology Project (2005 - 2006)

Project Introduction

NextGen Aeronautics, Inc. and their partner, Virginia Tech, propose to develop a self-healing material for wire insulation using a class of poly(ethylene-co-methacrylic acid) (EMAA) and poly(tetramethylene oxide) ionomer polymers. The self-healing property of these materials is strongly correlated with the thermal processes that occur during and after damage initiation. Recent experimental results have demonstrated that penetration of the polymer by a projectile causes localized heating near the puncture. The heating then causes a localized melt elastic response which serves to close the puncture and 'heal' the polymer. Since self-healing has already been demonstrated using these materials, the major technical challenge of this STTR effort is to stimulate the localized melt elastic response that has been shown to initiate self-healing. Our concept is to incorporate a magnetically-response phase into the insulating polymer for the purpose of causing localized heating during high-frequency excitation of the polymer. This magnetic phase will be located close to the electrical conductor. Localized heating will cause flow into the crack and, upon cooling, the crack will close over the wire and eliminate the exposure of the bare wire.

Anticipated Benefits

Self-healing wire insulation materials will have wide-spread commercial applications wherever electrical power is utilized ? all kinds of automobiles, commercial buildings, homes etc. They could also be used in computer systems to improve reliability and reduce maintenance. Utilizing self-healing materials for wire insulation will have direct benefits to an array of NASA commercial applications. These include development of smart, low-maintenance commercial transport and business aircraft, the next generation of spacecraft and inter-planetary vehicles, as well as mission critical infra-structures such as launch platforms and complex support equipment.



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Johnson Space Center (JSC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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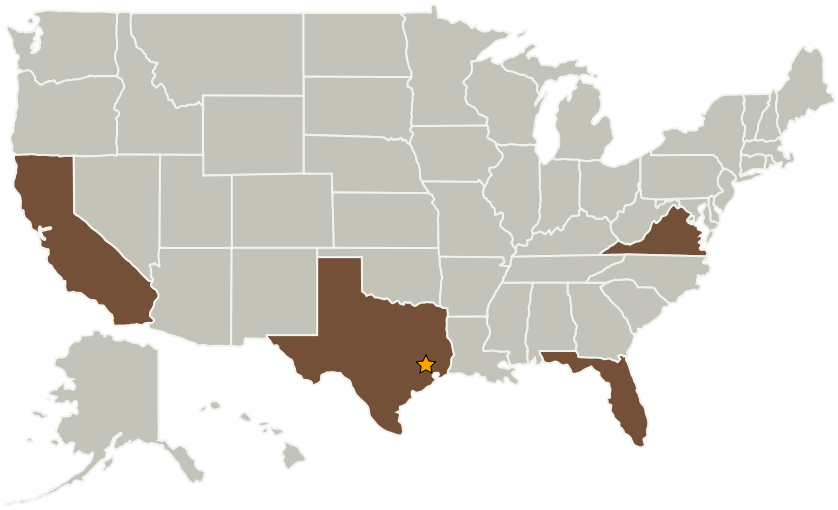
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Johnson Space Center(JSC)	Lead Organization	NASA Center	Houston, Texas
NextGen Aeronautics, Inc.	Supporting Organization	Industry Minority-Owned Business, Small Disadvantaged Business (SDB)	Torrance, California
Virginia Polytechnic Institute and State University(VA Tech)	Supporting Organization	Academia	Blacksburg, Virginia

Primary U.S. Work Locations	
California	Florida
Texas	Virginia

Project Management

Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Project Manager:
Clyde F Parrish

Principal Investigators:
Anna Stewart
Scott Von Laven

Technology Areas

Primary:

- TX14 Thermal Management Systems
  - TX14.3 Thermal Protection Components and Systems
    - TX14.3.1 Thermal Protection Materials